

Federal Republic of Germany  
German Patent Office

Int. Class:     **B 29 C 27/02**  
                  **F 28 F 21/06**

**GERMAN (DE-OS) 32 12 295 A1**

(Provisional Publication)

Serial No.:       **P 32 12 295.0**  
Filing Date:     **April 2, 1982**  
Laid-Open Date:  **Oct. 6, 1983**

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**Title:**           **A Process for Bonding Two Surfaces of Plates**

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**Abstract**

At a process for bonding two surfaces of plastic plates or the like of a fusible material, an electric conductor is placed between the base surface of the one plate and the respective contacting surface of the other plate and is heated above the melting point of the surrounding material of the plates. This process is particularly suited for preparing a heat-exchanger, in which a temperature controlled medium is passed in channels between the two plates of a fusible plastic material from an inlet point to an outlet point. Thereby, at a minimal spacing (a) between the channels (7) and at a distance (b) from the edge (12) of the heat-exchanger (W), a groove (11) is formed in the contacting surface (4) of the one plate (2), in which an electrically conductive wire (14) is placed. After having placed the one plate (1) on top of the other, the wire is connected to an electric power source and the plastic material surrounding the wire, will be molten and fused with the plastic material of the other plate.

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**A Process for Bonding Two Surfaces of Plates**

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**PATENT CLAIMS**

1. A process for bonding two surface areas of plates of a plastic material or the like, consisting of a fusible material, wherein an electric conductor is placed between the base surface of the one plate and the contacting surface of the other plate and is heated above the melting point of the surrounding material of the plate.
2. A process according to claim 1, wherein a groove is formed in the one plate and/or the other plate for placing the electric conductor.
3. A process according to claim 1 or 2, wherein a wire is placed between the plates and is connected to an electric power source.
4. A process for preparing a heat-exchanger, in which a temperature controlled medium is passed in channels from an inlet point to an outlet point between the two plates of a plastic material or the like consisting of a fusible material, wherein at a minimal spacing (a) between the channels (7) and at a distance (b) from the edge (12) of the heat-exchanger (W), a groove (11) is formed in the contacting surface (4) of the one plate (2), in which an electrically conductive wire (14) is placed, by which after the placing of the other plate (1) and a connection to an electric power source, the surrounding plastic material is molten and fused with the plastic material of the other plate.
5. A heat-exchanger with two plates of a plastic material or the like consisting of a fusible material, between which channels are arranged for passing a temperature controlled medium from an inlet point to an outlet point, wherein a groove (11) is formed around the channels (7) in the one and/or the other plate (1 or 2, respectively), in which an electrically conductive wire (14) is placed, which is connected to an electric power source.

6. A heat-exchanger according to claim 5, wherein the groove has a minimal distance (a) to the channels (7) and a distance (b) to the edge side (12) of the heat-exchanger (W).
  7. A heat-exchanger according to claim 5 or 6, wherein the wire (14) consists of an easily heatable metal.
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### **DESCRIPTION**

The invention deals with a process for bonding two surface areas of plates of a plastic material or the like, consisting of a fusible material, as well as with a process for preparing a heat-exchanger with two plastic plates or the like of a fusible material, between which channels are arranged for passing a temperature controlled medium from an inlet point to an outlet point.

The plastic plates or the like to be combined are usually held together by means of connection elements, such as screws, clamps or the like. An adhesive bonding of the plates placed on top of each other has also been known.

However, the combination of two plates by means of connection elements has the disadvantage, that leakage problems are experienced, if e.g. a liquid is passed through channels between the plates, such as in the case of a heat-exchanger.

Similar leakage or sealing problems will also occur, if the plates are adhesively bonded, since the adhesive can mostly not uniformly be applied. Besides, the adhesive shows fatigue limits after some time.

The objectives to be achieved by the present invention deals with a development of a process of the aforementioned kind, by which two plastic plates may be combined in a simple and durable manner, whereby this process is to be in particular useful for preparing heat-exchangers or the like.

These objectives have been achieved by a process, by which an electric conductor is placed between the base surface of the one plate and the contacting surface of the other plate and is heated above the melting point of the surrounding material of the plate.

Due to this process, an intimate bonding of the two plates is achieved by a fusion of the two materials, which is of an unlimited duration.

The electric conductor may also be placed into a groove, which has been prepared prior to the combination of the two plates in the one and/or the other plate.

Preferably, a wire is used as the electric conductor, which is connected to an electric power source. However, the invention is not limited to the usage of a wire as an electric conductor, a foil- or film-like electric conductor may e.g. also be used.

Usually, the electric conductor will remain between the plates after usage, i.e. after the fusion of the two surfaces of the plates.

This process described in the foregoing, has been proven to be particularly advantageous for preparing a heat-exchanger, in which a temperature controlled medium is passed through channels from an inlet point to an outlet point between the two plastic plates of a fusible material. In this case, a groove is formed at a minimal distance from the channels and at a distance from the side edges of the heat-exchanger, in which an electrically conductive wire is placed for fusing the material of the one plate with the material of the other plate after a connection of this wire to an electric power source.

Thereby, it is possible to provide only one plate, the so-called carrier plate, with the channels and with the groove for the electric wire. Therefore, the thickness of this plate will usually be larger than the thickness of the cover plate, which may even have unfinished exterior surfaces.

The minimal distance to the channels, as well as the distance to the side edges of the heat-exchanger are to be so large, that neither the channels nor the side edges will be affected by the fusion process.

After the fusion- (or bonding-) process, the wire will be cut off at the side edges of the heat-exchanger and may e.g. be filed to a smooth surface. During the further usage, the wire will remain in the heat-exchanger.

The invention deals also with a heat-exchanger prepared by this process.

It is to be particularly emphasized, that the method of preparation may be carried out in a simple manner and with little expenditures, whereby the effect is, however, extremely advantageous.

Additional advantages, criteria and details of the invention may be derived from the following description of a preferred execution example and from the attached drawings. \*)

Fig. 1 shows a rear view of a heat-exchanger.

Fig. 2 shows a part of an enlarged cross-section through a heat-exchanger along the line II - II in fig. 1.

At an heat-exchanger (W), a smooth surface area (3) of a rectangular plastic plate (1) with the thickness (d) is placed onto a carrier plate (2) with the thickness (e) and a contacting surface area (4). The exterior surfaces (5,6) of both plates (1,2) are smooth finished.

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\*) The German original document was submitted without the drawings. -- HLS

The contacting surface area (4) of the carrier plate (2) is provided with channels (7) with a depth (t) for passing a heat-exchanger medium. Thereby, the channels (7) are formed in a wavy line under the formation intermediate stays (16) and extend over the contacting surface area (4) from an inlet opening for the medium (see fig. 1, upper right corner) to an outlet opening (9) situated in the diagonal opposite corner. The arrangement of the channels (7) is illustrated in fig. 1 by the dashed lines.

The intermediate stays (16) extend in a wedge-shaped manner under the formation of an angle ( $\omega$ ) and a peak (17), whereby the angle ( $\omega$ ) is formed in such a way, that an about 5% gradient is obtained for the medium between the inlet (8) and the outlet (9).

The channels (7) are surrounded by a groove (11), which has a minimal distance (a) from the channels and a distance (b) from the side edge (12) of the heat-exchanger (W) and which is provided with an inlet- and outlet opening (15). In the groove (11), an electrically conductive wire (14) is placed, which -- not shown in the drawings -- is connected to an electric power source.

After the carrier plate (2) has been provided with the channels (7) and the groove (11), as well as with a bore-hole for the outlet (9) and a bore-hole for the inlet (8), a wire (14) is placed into the groove (11) and the surface area (4) is covered with the cover-plate (1). By connecting the wire (14) to an electric power source, this wire is heated and will melt the plastic material in the surrounding area, whereby the two plates (1,2) will be bonded to each other. Then, the two ends of the wire (14) extending out of the heat-exchanger (W), may be cut off and the heat-exchanger (W) may be installed in a device, such as e.g. a cooling device for a test-gas at a gas-analysis equipment and may be connected into the cycling system of the heat-exchanger medium.

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The page with the said 2 drawings is evidently missing.

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*Date: December 3, 1999*